UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/644,957	08/21/2003	Gordon Bease	071469-0305396	7598

909 7590 09/20/2005

PILLSBURY WINTHROP SHAW PITTMAN, LLP
P.O. BOX 10500
MCLEAN, VA 22102

EXAMINER	
ARANCIBIA, MAUREEN GRAMAGLIA	
ART UNIT	**PAPER NUMBER**
1763	

DATE MAILED: 09/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/644,957	BEASE ET AL.	
	Examiner	Art Unit	
	Maureen G. Arancibia	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) *17-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I, Claims 1-16 in the reply filed on 20 July 2005 is acknowledged.

2. Claims 17-36 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 20 July 2005.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-4, 6-10, 15, and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,818,553 to Yu et al.

Yu et al. teaches a method of processing a layer 14 containing a high-permittivity (high-k) material (Column 2, Lines 24-25) overlying a substrate 10, comprising providing said high-k layer (Column 2, Lines 24-25); modifying said high-k layer by exposing it to a plasma (Column 2, Line 63 - Column 3, Line 6); and wet etching to remove the modified high-k layer (Column 3, Lines 45-51).

In regards to Claims 2 and 3, the modification performed by exposure to the plasma partially removes the high-k layer, thereby disrupting the atomic structure of the layer by removing part of it and leaving partially etched layer 14'. (Column 3, Lines 3-5; Figure 4)

In regards to Claim 4, Yu et al. teaches that the processing method comprises creating a plasma from a process gas comprising a reactive (fluorine-based) gas. (Column 3, Lines 33-45)

In regards to Claims 6-9, Yu et al. further teaches that the process gas can comprise an inert gas such as helium or argon. (Column 3, Lines 14-16)

In regards to Claim 10, Yu et al. teaches that the high-permittivity (high-k) material can comprise HfSiO. (Column 2, Line 29)

In regards to Claim 15, see the discussion of Claim 4.

In regards to Claim 16, see the discussion of Claim 4. Yu et al. additionally teaches that the modification performed by exposure to the plasma is anisotropic. (See Figure 4)

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent 6,579,809 to Yang et al.

The teachings of Yu et al. were discussed above.

In regards to Claim 5, Yu et al. does not expressly teach that the process gas can comprise at least one of HBr and HCl.

Yang et al. teaches that a high-k layer 62 (Column 5, Lines 7-9) can be etched with plasma created from a process gas comprising HBr. (Column 7, Lines 20-27)

It would have been obvious to one of ordinary skill in the art to modify the process gas taught by Yu et al. to comprise HBr, as taught by Yang et al. The motivation for doing so, as taught by Yang et al. (Column 7, Lines 22-23), would have been to make the etching conditions selective for the high-k material over the underlying silicon substrate.

7. Claims 11, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent 6,536,449 to Ranft et al.

The teachings of Yu et al. were discussed above.

Yu et al. does not expressly teach that a substrate holder exposing the substrate to the plasma should be RF powered (as recited in Claim 11), grounded (as recited in Claim 12), or electrically isolated (as recited in Claim 14).

Ranft et al. teaches a substrate holder 104 for use in a plasma etching method (Column 5, Lines 4-8) can be grounded (Column 5, Line 40), electrically isolated (Column 5, Lines 50-52), or RF powered (Column 5, Lines 57-58).

It would have been obvious to one of ordinary skill in the art to modify the method taught by Yu et al. to ground the substrate holder (as recited in Claim 12), electrically isolate the substrate holder (as recited in Claim 14), or RF power the substrate holder

(as recited in Claim 11). The motivation for grounding the substrate holder, as taught by Ranft et al. (Column 5, Lines 40-50), would have been to etch with higher currents and energies of ion bombardment. The motivation for electrically isolating the substrate holder, as taught by Ranft et al. (Column 5, Lines 50-54), would have been to decrease ion bombardment on the substrate, i.e. to have a gentler etch process. The motivation for supplying RF power to the substrate holder, as taught by Ranft et al. (Column 5, Lines 57-60), would have been to accelerate ions toward the substrate to enhance etching.

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al. in view of U.S. Patent Application Publication 2001/0003271 to Otsuki.

The teachings of Yu et al. were discussed above.

Yu et al. does not expressly teach that a substrate holder exposing the substrate to the plasma should have a DC bias.

Otsuki teaches that a substrate holder 24 that exposes a substrate W to a plasma (Paragraph 57) can have a DC bias. (Paragraph 48)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Yu et al. to supply the substrate holder with a DC bias, as taught by Otsuki. The motivation for doing so, as taught by Otsuki (Paragraph 48), would have been to electrostatically attract the substrate to the holder.

Double Patenting

9. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11

F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. Claims 1-16 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 93 and 95-104 of copending Application No. 10/670,795 ('795) in view of Yu et al., Ranft et al., and Otsuki.

In regards to Claim 1, Claim 93 of '795 recites a method of processing a provided layer containing a high-permittivity material, comprising modifying the layer by exposing it to a plasma, and etching the modified layer in the absence of plasma.

Claim 93 of '795 does not recite that the etching step should be a wet etching, or that the etching step can remove the modified layer.

Yu et al. teaches that a plasma-modified high-permittivity (high-k) layer can be removed by wet etching (Column 3, Lines 45-51).

It would have been obvious to one of ordinary skill in the art to modify the method recited in Claim 93 of '795 to make the etching step a wet etching, and to remove the modified layer during the etching step. The motivation for making the etching step a wet etching, as taught by Yu et al. (Column 3, Line 66 - Column 4, Line 10), would have been to perform a selective etch that does not require masking of the substrate and

does not damage other features of the substrate (ex. source/drain areas). The motivation for using the etching step to remove the modified layer, as taught by Yu et al. (Column 3, Lines 52-54) would have been to define a feature (ex. a gate electrode) on the substrate.

In regards to Claim 2, Claim 96 of '795 recites that the modifying step partially removes the high-permittivity layer.

In regards to Claim 3, Claim 97 of '795 recites that the modifying step partially disassociates the high-permittivity layer, which would disrupt the atomic structure of the layer.

In regards to Claim 4, Claim 95 of '795 recites that the substrate is provided in a process chamber, while Claim 98 of '795 recites that the process gas that creates the plasma comprises a reactive gas.

In regards to Claims 5-9, Claims 99-103 of '795 recite the claimed limitations.

In regards to Claim 10, Claim 104 of '795 recites the claimed limitation.

In regards to Claims 11, 12, and 14, the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 does not expressly teach that a substrate holder exposing the substrate to the plasma should be RF powered (as recited in Claim 11), grounded (as recited in Claim 12), or electrically isolated (as recited in Claim 14).

Ranft et al. teaches a substrate holder 104 for use in a plasma etching method (Column 5, Lines 4-8) can be grounded (Column 5, Line 40), electrically isolated (Column 5, Lines 50-52), or RF powered (Column 5, Lines 57-58).

It would have been obvious to one of ordinary skill in the art to modify the method taught by the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 to ground the substrate holder (as recited in Claim 12), electrically isolate the substrate holder (as recited in Claim 14), or RF power the substrate holder (as recited in Claim 11). The motivation for grounding the substrate holder, as taught by Ranft et al. (Column 5, Lines 40-50), would have been to etch with higher currents and energies of ion bombardment. The motivation for electrically isolating the substrate holder, as taught by Ranft et al. (Column 5, Lines 50-54), would have been to decrease ion bombardment on the substrate, i.e. to have a gentler etch process. The motivation for supplying RF power to the substrate holder, as taught by Ranft et al. (Column 5, Lines 57-60), would have been to accelerate ions toward the substrate to enhance etching.

In regards to Claim 13, the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 does not expressly teach that a substrate holder exposing the substrate to the plasma should have a DC bias.

Otsuki teaches that a substrate holder 24 that exposes a substrate W to a plasma (Paragraph 57) can have a DC bias. (Paragraph 48)

It would have been obvious to one of ordinary skill in the art to modify the method taught by the combination of Claim 93 of '795 and Yu et al. as applied to Claim 1 to supply the substrate holder with a DC bias, as taught by Otsuki. The motivation for doing so, as taught by Otsuki (Paragraph 48), would have been to electrostatically attract the substrate to the holder.

In regards to Claim 15, see the discussion of Claims 1 and 4.

In regards to Claim 16, see the discussion of Claims 1 and 4.

The combination of Claims 93 and 95 of '795 and Yu et al. discussed above does not expressly teach that the plasma modification step should proceed anisotropically.

However, Yu et al. further teaches that a plasma modification of a high-permittivity (high-k) layer can take place anisotropically. (See Figure 4)

It would have been obvious to one of ordinary skill in the art to perform the plasma modification step anisotropically, as taught by Yu et al. The motivation for doing so would have been to form smooth vertical sidewalls to define features on the substrate.

This is a provisional obviousness-type double patenting rejection.

Response to Arguments

11. Applicant's arguments filed 20 July 2005 have been fully considered but they are not persuasive.

In regards to Applicant's argument that Yu et al. does not teach "modifying" the layer containing the high-permittivity material, the Examiner responds that Yu et al. teaches exposing a layer 14 containing a high-permittivity material to a plasma (Column 3, Lines 1-6), which modifies the layer by removing part of it. Moreover, removing part of a layer constitutes disrupting the atomic structure of the layer as broadly recited in Claim 3.

It is noted that the features upon which applicant relies (i.e., that "modifying" constitutes increasing the amorphous content of the high-k layer) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification,

limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Moreover, even if Applicant were to further amend the claims to recite such a mechanism for the "modification," the Examiner notes the section of the specification to which Applicant refers (Paragraph 25) merely sets forth a possible mechanism for what happens to the high-k layer upon exposure to the plasma. The Examiner asserts that since Yu et al. teaches an identical method of exposing the high-k layer to a plasma, any "modification" that takes place to the layer would inherently be the same as that disclosed by Applicant.

Further, contrary to Applicant's assertion, Yu et al. clearly teaches removing the modified high-k layer. (Column 3, Lines 45-51)

In response to applicant's arguments against the remaining references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Finally, the Examiner notes that Applicant failed to address the obviousness-type double patenting rejection of the claims over Claims 93 and 95-104 of copending Application No. 10/670,795 in view of Yu et al., Ranft et al., and Otsuki.

Conclusion

12. Applicant's amendment necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Maureen G. Arancibia
Patent Examiner
Art Unit 1763

Parviz Hassanzadeh
Supervisory Patent Examiner
Art Unit 1763